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**EXPANDING MANDREL METHOD AND PRODUCT PRODUCED THEREBY**
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- (57) Claim

1. An expanding mandrel for use in connecting pipe or tube passing in a close fitting relationship through an aperture in a member,

said mandrel having a hollow body portion with a forward nose for fitting within the pipe or tube and for locating longitudinally with the forward nose at the position of the aperture, whereby a mandrel pin can be used for engaging internally of said mandrel with at least the forward nose to cause it to expand radially outwardly as said mandrel pin is driven into the forward nose, the external surface of said forward nose having pipe or tube deforming surfaces which will radially expand the pipe or tube in the region of said aperture when said forward nose is expanded radially by said mandrel pin so the pipe or tube will extend over surfaces of both faces of said member at said aperture, thereby connecting the pipe or tube to said member.

11. A method as claimed in claim 10 comprising using a mandrel as claimed in any one of claims 1 to 9.

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COMPLETE SPECIFICATION

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TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:  
EXPANDING MANDREL METHOD AND PRODUCT PRODUCED THEREBY

The following statement is a full description of this invention  
including the best method of performing it known to me:-

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EXPANDING MANDREL METHOD  
AND PRODUCT PRODUCED THEREBY

Field of the Invention

5 This invention relates to an expanding mandrel  
and to a product produced thereby and relates particularly  
but not exclusively to a mandrel suitable for making  
products which utilize tube or pipe materials. Typical  
examples of such products comprise fences such as swimming  
pool safety fences, grills and other similar products.

Description of Prior Art

10 Hitherto in the art of producing swimming pool  
fences it has been common to provide tubular upright  
members which are interconnected to top and bottom rails  
which are situated at distances such as 12 cm from the  
15 extreme top and bottom ends of the upright members. The  
interconnection has been by a crimping of the rails  
against the upright tubular members. Such production has

been relatively expensive and has not lent itself to on-sight fabrication owing to the need to have rather large crimping apparatus for affecting the necessary crimping to the rails:

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Object and Statement of Invention

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The present invention has been devised with the object of providing an improved expanding mandrel and products produced thereby which mandrel can, in one example, be used for on site construction of swimming pool fence panels.

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Therefore in accordance with the first broad aspect of the present invention there may be provided an expanding mandrel for use in connecting pipe or tube passing in a close fitting relationship through an aperture in a member,

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said mandrel having a hollow body portion with a forward nose for fitting within the pipe or tube and for locating longitudinally with the forward nose at the position of the aperture, whereby a mandrel pin can be used for engaging internally of said mandrel with at least the forward nose to cause it to expand radially outwardly as said mandrel pin is driven into the forward nose, the external surface of said forward nose having pipe or tube deforming surfaces which will radially expand the pipe or tube in the region of said aperture when said forward nose is expanded radially by said mandrel pin so the pipe or tube will extend over surfaces of both faces of said member at said aperture, thereby connecting the pipe or tube to said member.

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Most preferably the mandrel pin passes through the body of the mandrel towards the forward nose and the forward nose is hollow so that a forward end of said mandrel pin can pass completely through said mandrel and wherein a mandrel pin relief is provided in said mandrel pin which will allow the forward nose to radially retract to enable said mandrel and said mandrel pin to be

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withdrawn from said pipe or tube.

Products made by using the mandrel and mandrel pin are within the scope of the invention.

A method of producing products is also provided.

5 To that end there may be provided a method of connecting pipe or tube to a member, said pipe or tube passing in close fitting relationship through said aperture in a member; said method comprising inserting a hollow mandrel into said pipe or tube so two longitudinally spaced  
10 apart circumferentially extending surfaces of a forward nose locate at positions internally of said pipe or tube so that one is adjacent one face of said member and the other is adjacent the other face of said member, moving a mandrel pin past said forward nose to cause it to radially expand  
15 to simultaneously deform surfaces of said pipe tube over both faces of said member, subsequently causing said mandrel to radially retract by further movement of said mandrel pin, and then withdrawing said mandrel from said pipe or tube.

## 20 Brief Description of the Drawings

In order that the invention can be more clearly ascertained examples of preferred embodiments will now be described with reference to the accompanying drawings wherein,

Figure 1 is a perspective view of one preferred  
25 mandrel;

Figure 2 is a perspective view of one preferred mandrel pin for the mandrel shown in Figure 1;

Figure 3 is an end view of the mandrel shown in Figure 1 at the rear end;

30 Figure 4 is an end view of the forward nose end

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of said mandrel;

Figure 5 is a side view of the mandrel;

Figure 6 is a view similar to Figure 5 taken on a section line along the longitudinal axis of said

5 mandrel;

Figures 7 through 10 respectively show various stages in operation of the mandrel and mandrel pin;

Figure 11 is a perspective view of a product in the form of a swimming pool fence made with the mandrel;

10 Figure 12 is a perspective view of a jig used for holding components of the fence shown in Figure 11 to permit easy assembly;

Figure 13 shows a modification of the mandrel for use with a different cross sectional pipe or tube to that in the previous embodiments; and

Figure 14 shows how a grill can be manufactured with the mandrel using various length pipes or tubes.

Detailed Description of Preferred Embodiment

Referring now to Figures 1 through 6 it can be  
20 seen that there is provided a circular cross section mandrel 1 and a corresponding mandrel pin 3. The mandrel 1 is hollow and has a forward nose 5 and a rear end 7. The mandrel 1 is made from a suitable steel and suitably hardened. The forward nose 5 has two circumferential  
25 extending ribs 9 and 11 on the outer surface. A trough 13 is provided between the ribs 9 and 11. It can be seen that the ribs 9 and 11 have a greater radial extent than a body portion 15 of the mandrel 1. It can also be seen that the trough 13 has a radially innermost extent  
30 corresponding approximately to the radially outermost extent of the body portion 15. In other words, the bottom of the trough 13 has approximately the same diameter as the outer surface of the body portion 15. The body portion 15 has slots 17 machined therein which in the  
35 present embodiment provide four fingers 19, 21, 23, 25. The respective fingers 19, 21, 23, 25 form respective

equally sized quadrant portions at the forward nose 5.

Figure 6 shows that the mandrel 1 has an inner bore 27 - i.e. the mandrel 1 is hollow. The forward nose 5 has a radially inwardly directed portion 29. Thus, the diameter of the bore is greater in the body portion 15 than between the portion 29 at the forward nose 5 so the portion 29 has a smaller radial extent than the bore.

The mandrel pin 3 is of a length greater than the length of the mandrel 1 and has a forward nose 31 which is of a larger diameter than the diameter of the body portion 33 of the mandrel pin 3. The body portion 33 extends immediately from the forward nose 31 to a relief portion 35 of smaller diameter than that of the body portion 33. The relief portion 35 extends only a short length longitudinally of the mandrel pin 3. The leading surface of the forward nose 31 is curved slightly to assist entry into the bore 27 and to enable the mandrel pin 3 to have its forward nose 31 pass the nose 5 of the mandrel 1. The mandrel pin 3 is made from a suitable steel which may be suitably hardened.

In use, the mandrel pin 3 is inserted into the bore 27 so that the forward nose 31 engages with the portion 29. It is then driven further into the nose 5 and as a consequence there will be radially expansion of at least the forward nose 5 of the mandrel 1. It can be seen that the surfaces of the portion 29 which lead to the surfaces of the bore 27 are inclined to permit a smooth transition between the bore 27 and portion 29. Thus, the mandrel pin 3 can be driven into the mandrel 1 to cause the forward nose 5 of the mandrel 1 to radially expand. As the mandrel pin 3 is driven further into the bore 27, the portion 29 will locate within the relief 35 in the mandrel pin 3 and allow the forward nose 5 to radially retract. This will be explained later in relation to Figures 7 through 10.

Referring now to Figures 7 through 10 it can be

seen how the mandrel 1 and mandrel pin 3 are used to fix a pipe or tube to a member.

Figure 8 shows that a metal such as an aluminium pipe or tube 37 has been passed through an aperture in a metal such as an aluminium member 39 in close fitting relationship with the aperture. In other words, the diameter of the aperture approximately equals the outer diameter of the pipe or tube 37 so that the pipe or tube 37 can be neatly received within the aperture. Typically the member can comprise a plate. The mandrel 1 is inserted through the hollow pipe or tube 37 so that the forward nose 5 locates adjacent the aperture with the ribs 9 and 11 adjacent each of the respective faces of the member 39 and the trough 13 generally aligned with the member 39. Thus, it can be seen that the spacing of the ribs 9 and 11 is chosen to suit a particular thickness of member 39. The spacing of the ribs 9 and 11 is greater than the thickness of the member 39 but the exact spacing is determined by the desired appearance of the external surfaces of the product at the connection of the pipe or tube 37 to the member 39.

Referring now to Figure 9 it can be seen how the mandrel 3 has been driven so that its forward nose 31 is adjacent the forward nose 5 of the mandrel 1. Thus, the forward nose 31 of the mandrel 3 has entered the portion 29. Accordingly, the mandrel pin 3 has caused the mandrel fingers 19, 21, 23, 25 to expand radially outwardly to, in turn, cause the material of the pipe or tube 37 to radially expand about both faces of the member around the aperture. Thus, it can be seen there is provided deformations 41 and 43 of the pipe or tube 37 which secure the pipe or tube 37 relative to the member 39.

In Figure 10 the mandrel pin 3 has been driven through the mandrel 1 so that the portion 29 locates within the relief portion 35 of the mandrel pin 3. Thus, the fingers 19, 21, 23, 25 of the mandrel 1 are radially

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retracted to their normal free position so that the ribs 9 and 11 are radially innermost of the inner diameter of the pipe or tube 37. The mandrel 1 has therefore effected a radially outward expansion of the pipe or tube 37 at the region of the aperture so there will be surfaces 41 and 43 radially expanded in the pipe or tube 37 which will hold the pipe or tube 37 relative to the member 39.

Because the mandrel 1 is made from steel it has a resilient nature and thus the radial expansion of the fingers 19, 21, 23, 25 will not permanently deform the mandrel 3 so that the fingers 19, 21, 23, 25 can return to their original free position so that the ribs 9 and 11 at the forward nose 5 of the mandrel 1 will be radially innermost of the pipe or tube 37 when portion 29 is located in relief 35. Thus, the mandrel 1 and the mandrel pin 33 can be withdrawn from the pipe or tube 37 after the connection has been made.

Figure 10 shows how a collar 45 is fitted over the mandrel 1 so that the collar 45 locates against the head 7 and against the top of the pipe or tube 37. Thus, the collar 45 serves as a spacer to correctly locate the position of the forward nose 5 of the mandrel 1 relative to the member 39. In this way, a single mandrel and corresponding mandrel pin 3 can be provided and by using appropriately lengthed collars 45, the mandrel 1 and mandrel pin 3 can be used to provide attachment of the pipe or tube 37 to the member 39 at desired spacing from the free end of the pipe or tube 37.

Referring now to Figure 11 there is shown one preferred form of fencing made using the mandrel shown in Figures 1 through 10. The fencing shown in Figure 11 can be of metal such as of aluminium and therefore suitable for use in swimming pool fencing situations or other situations. Here there is provided a lower rail 47 and an upper rail 49. Each of the lower rail and upper rail 47 and 49 are provided from U-shaped extruded aluminium. A

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